Profiles of the first 3 Lighthouse Farms Enrolled in the SPIS-4-FNS Project in Laikipia, Isiolo and Meru Counties, Kenya

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These profiles outline the baseline conditions, before SPIS equipment were installed

1. Background

1.1 About the SPIS-4-FNS Project

Upscaling Food and Nutrition Security through Solar Powered Irrigation integrated with Rainwater Harvesting for Small-scale Farmers in the Upper Ewaso Ng'iro Basin, Kenya (**SPIS-4-FNS**) is a research project funded by the Germany Federal Ministry of Food and Agriculture (Bundesministeriums für Ernährung und Landwirtschaft - BMEL). The project is implemented by the SusLAND research group at ZALF, Germany in collaboration with JKUATES and JKUAT in Kenya. Other partners are PV-Projects and FiW of Germany, and AIAP and MKEWP of Kenya. The project started with a preparatory Initial phase in 2023, after which the full proposal was developed. The full 3-year research project commenced in February 2025.

1.1 Identifying the starter three (3) Lighthouse Farms

The identification of the three (3) starter lighthouse farms started during the project initial phase in 2023. A baseline survey was conducted in Laikipia, Meru and Isiolo counties to understand the local context and identify gaps which can be addressed through SPIS. Questionnaire surveys were conducted and interviewed 173 respondents who included 57 in Laikipia, 57 in Meru and 59 in Isiolo. All the farms visited had irrigation where water pumping was necessary. In addition, all the farms in Laikipia and Meru had water harvesting pans while those in Isiolo had shallow groundwater wells used for irrigation. The information gathered from these respondents was enriched with data from key informants mainly government officials and relevant organizations such as WRUAs. The purpose was to probe on the use of solar powered irrigation in the three counties. At the time, only 3 farms had some form of solar water pumping for irrigation.

Using the findings of the baseline survey, farms that met some basic criteria were visited by the research teams in August-Sept 2023 for identification of candidate Lighthouse farms (LHF). The LHFs would then act as research hubs and for training other farmers. In the selection of

[1]*These profiles obtained data from questionnaire surveys conducted by Amos Kareithi in August 2025, and field visits by Prof. Bancy Mati*

the LHF farmers, one criteria was opportunity to use solar power to upscale irrigation, space for research, willingness of the farmer to participate as a demo farm, and locality in terms of other farmers learning from the selected farmer. The LHF farms were intended to become living labs for learning and innovation on solar powered irrigation systems (SPIS).

In addition, a consultation workshop attended by 33 participants was held on 1st September 2023 in Nanyuki, to introduce the SPIS project to stakeholders. The main objective of the workshop was to integrate the views of stakeholders to final proposal in a way captures their views, needs and support for the SPIS project. The participants explored the role that water harvesting and solar powered irrigation can play in order to boost food production and reduce cost of production by cutting the costs of fossil fuels and grid electricity especially in the light of global warming and climate change. The participants appreciated that so far solar pumping was taking roots in Kenya mainly promoted by researchers, government officers, private companies among other stakeholders but now needed to be mainstreamed in the country. The key issues that emerged from this workshop were

- Rivers and springs are drying up due to climate change and over-abstraction of water.
- Boreholes and shallow wells are prevalent in all counties however, water insufficiency, salinity especially in boreholes, pollution and silting of rivers are common.
- Most people use diesel, petrol and mains electricity for pumping water, however solar power to a smaller extent is being used by a few farmers.
- Knowledge on solar power is still low, initial costs are still high and lack of after sale service is a problem.
- There is no problem of market, however the middlemen reduce the farmers profits by buying at below current market prices .
- Farmers require training and support in their farms for better agronomic practices
- Due to climate change, the environment is becoming harsher by day and therefore People need to work together in reducing and mitigating this phenomenon,
- That majority farmers are interested in solar pumping going forward
- There is need for integrating project with all stakeholders and beneficiaries for impact and sustainability. Co-Creation among all the project partners is critical in ensuring success and sustainability.
- Stakeholders-various stakeholders were mentioned in the area including national government; county governments, NGOs; private companies; faith based organizations among others including the various roles they play in the three counties hence the need for farmers to be socially accountable environmental matters.
- Water and environmental conservation efforts were needed; and
- Water recycling technologies need to be explored for optimizing scarce water resources.

1.3 Selection of three Lighthouse farms for 2025

The research team used a participatory method and scoring system to agree on the starter three Lighthouse farms. These were identified to be:

1) Laikipia- Mrs. Susan Mwangi
2) Meru – Mr. Edward Mutiga
3) Isiolo – Mr. George Kaiyo

These farms were assessed in greater detail and adopted as the first three LHFs in May 2025.

2.0 Detailed Survey of the Lighthouse Farms

This report presents the findings of the detailed survey conducted on the three LHFs in August 2025. The study was meant to capture more details on each Lighthouse farm selected to be equipped with solar powered irrigation equipment to become research sites (Living labs) as well as demonstration farms for other farmers (cluster farmers) for cross learning. Since rainwater harvesting and solar irrigation technology are two central concerns of the collaboration, this study aims at providing important information about the farms in order to adequately implement potential technical, operational and business management solutions on the selected sites.

The information is crucial for the adequate and appropriate implementation of the research design, as well as for optimal economic and technical feasibility and the achieved results. This survey gathered information on the geographical, legal, economic, social, business aspects of the intended collaboration on SPIS research and training at the selected LHFs.

3.0 Salient Features of the Three LHFs

In this chapter, we unpack the salient features of each of 3 LHFs.

3.1 Laikipia County

In Laikipia County, Mrs. Susan Mwangi was selected as the lighthouse farmer (LHF).

Water pan for rainwater harvesting at Susan's farm

Irrigated citrus trees at Susan's farm

3.1.1 Geographic Aspects

Fanaka Farm is owned by Susan Mwangi and is approximately 5 acres (2 ha). It is located in Laikipia East Sub county, Tigithi Ward, Kamangura village with the following GPS coordinates: (S 0^0 2' 51.84", E 37^0 0'51.10). The topography is flat and the soils are volcanic ashes and fertile, hence all parts of the farm are uniformly suitable for agriculture. It is a mixed farm with crops and livestock, but fruit trees mainly avocados and oranges are the main irrigated crops. The animals kept are Dorper sheep and poultry. There is some napier grass and trees on farm.

The weather alternates from rainy to dry seasons. The long rains come from March to May while the short rains come between October and November. The dry months are January and February and from June to September and also December month of late meaning there are seven dry months in a typical year. On average the annual rainfall is approximated at 1,300 mm but of late the patterns have become erratic and unreliable with frequent long spells of dry months followed by torrential rains that often cause flooding.

The farmer has not carried out any hydro-logical survey but a neighboring farm has sunk a borehole reaching the water at about 50 m deep, the water is slightly saline but can be safely used for irrigation. She has also not carried out any soil tests but is intending to do so in the near future.

There are no rivers or springs in the vicinity of the farm. The farmer has harvested rainwater from roofs and stored in a water pan of volume 1.2 millon litres, but she estimates that she needs at least 2 million litres of water-pan capacity in order to have enough water for irrigation throughout the year.

3.1.2 Legal aspects

The farmer is the owner of the land and there are no legal impediments or encumbrances on it.

3.1.3 Business Aspects

The farmer produces mainly oranges and avocado and harvests about two tons of avocados and four tons of oranges fetching about two hundred and sixty Kenya shillings each Harvey season. In the areas without fruit trees she rotates between sweet potatoes and beans.

The farmer markets her crop mainly through the word of mouth but recently her daughter has opened social media accounts for the farm which is helping in marketing and publicity. She has installed an electric pump, 0.75 Kw with a maximum pumping head of 70 metres.

The farmer receives technical support from the pump vendor who has an office in Nanyuki town a thirty minutes' drive from the farm, there are also local plumbers and technicians who assists in simple installations like drip irrigation and piping. The farmer has installed a drip irrigation system in the entire farm.

She currently is not working with any financial institutions but is considering joining a SACCO that has been newly launched in the area. They have a table banking women group where they save and borrow for minor expenses and emergencies. The farmer has two permanent farm workers and is supported by her husband, lately the daughter has taken interest especially in social media advertising and publicity.

3.1.3 Current Status of On farm training's

The farmer conducts training's for both individuals and groups. She currently trains between eight to ten farmers per month and charges one thousand for each trainee per session.

3.2 Meru County

Edward Mutiga Matiri was selected as the lighthouse farmer for Meru County.

A water pan at the farm of Edward Mutiga

Irrigated cabbage at the farm of Edward Mutiga

3.2.1 Geographical Aspects and ownership

The farm is located in Buuri East Sub-county, Kibirichia Ward, Mususune village with the following GPS Coordinates (N 0^0 5'42.93" and E 37^0 31' 27.50). Named Mukungu Farm, it is about 10 acres (4 ha) and is owned by the farmer. The topography is mixed with about three acres on hilly ground and the rest flat land. The soils are loamy and uniformly fertile hence making all the sections of the land suitable for agriculture. It's a mixed farm wi th vegetables including kales, cabbage, spinach, carrots, maize, potatoes, nappier grass and also dairy cows on zero grazing system.

The weather alternates from rainy to dry seasons. The long rains come from March to May while the short rains come between October and December. The dry months are January and February and from June to September meaning there are six dry months in a typical year. On average the annual rainfall is approximated to be about 1,233 mm but of late the patterns have become erratic and unreliable with frequent long spells and torrential rains that often cause flooding.

The farmer has not carried out any hydro-logical survey but a tried to dig a shallow well which turned out to be dry. The farmer has not carried soil tests either but intends to do so soon. There is a small seasonal spring that passes on the lower edge of the farm which the farmer uses for irrigation.

He has invested in roof catchment water harvesting stored in a water pan holding 2.3 million litres of water. He uses sprinkler irrigation but only a few sprinklers, necessitating having to move them from one field to the next. He would like to install sprinklers throughout the farm and thus requires a powerful solar pump owing to the sloppy nature of the land.

3.2.2 Legal aspects

The farmer is the owner of the land and there are no legal impediments or encumbrances on it.

3.2.3 Business Aspects

The farmer produces mainly vegetables including carrots, Cabbages, Kales and spinach but does not currently have exact production volumes data except for cabbages estimated at about 50,000 cabbages every season. He rotates, carrots, cabbages and potatoes. He markets his crops by word of mouth and has telephone contacts of brokers whom he calls whenever the crops are ready for sale.

The farmer has installed two electric pumps 1 amp and 2 amps which he bought from a company which gives technical support whenever needed. The county government Agronomist also offers support whenever called upon. The farmer uses overhead sprinklers for irrigation.

The farmer is a member of Capital SACCO who provides loans to fund farm activities. The farmer employs three permanent workers and is supported by his wife in most of the farming activities.

3.2.3 Current Status of On farm training's

The farmer conducts training's for both individuals and groups. He currently trains between five to ten farmers per month but does not charge them as he considers this to be knowledge sharing.

3.3 Isiolo County

In Isiolo County, George Kaiyo was selected as the lighthouse farmer.

The shallow well for irrigation dug by George

Furrow irrigation of tomatoes at George's farm

3.3.1 Geographical Aspects

George's farm is located in Isiolo Sub county, Burat Ward, Elsa Scheme with the following GPS Coordinates (N 0^0 16' 55.95", E 37^0 32' 16.06"). The topography is flat and the soils are black cotton clay of good fertility but usually gets waterlogged during the rainy season. It is used for small-scale production of vegetables, mostly tomato and onions for the local market. George is a youthful farmer who is also a leader of a local youth farmer group of around 30 members. George cultivates about 2 acres of fully irrigated farm within Elsa Scheme.

The weather alternates from rainy to dry seasons. The long rains come from March to May while the short rains come between October and December. The dry months are January and February and from June to September meaning there are six dry months in a typical year. On average the annual rainfall is approximated at Isiolo 635 mm per year. But the patterns have become erratic with frequent long spells and torrential rains that often cause flooding.

The water used for irrigation is sourced from a shallow well which is about 1.5 kilometres from the farm. The farmer uses a petrol pump to pump water from the source. George started farming through irrigation in 2019. He irrigates 1 acre in one day, and to save energy, he applies water once a week, which is not enough to meet crop demands.

The farmer has not carried out any hydrological survey but has dug a shallow well about 1.5 km away which supplies the water for irrigation by pumping using a petrol pump, and delivery using a 3-inch diameter pipe, and water shared with other farmers. From the pump, the water joins earthen canals which distribute water by gravity to the irrigated fields. Water application at field level is through furrows for tomatoes, and micro-basins for tomatoes. Generally, there is a lot of water wastage from delivery, distribution and application. The costs of petrol water pumping are high, thus dimming the profit margins for the farmer.

3.3.2 Legal aspects

The land is communally owned by the family of George and there are no legal impediments or encumbrances on its use.

3.3.3 Business Aspects

The farmer produces mainly vegetables including onions and tomatoes. The farmers are well organized and do crop rotations with a synchronized planting calendar pegged on market targeting to ensure critical mass and bargaining power for best price at harvest time. The farmers market their crops independently and buyers come to buy produce on-farm. George is a respected leader of the Elsa scheme community.

3.3.3 Current Status of On farm training's

The farmer conducts trainings for both individuals and groups. He is a community mobilizer and supports at least 30 youthful farmers, training them on agriculture. A majority are indigenous peoples (Turkana) who have had little experience with crop farming, while others were his former employees. He has inspired local youths to join irrigated farming.

3.3.4 Cross Cutting Issues

The farmers of Elsa scheme would like to be assisted to buy solar powered irrigation systems as well as construction of water harvesting ponds so that they can store rain water and ease the pressure on the well. Majority of farmers are indigenous peoples and youth, thus there is scope to enhance agriculture and clean energy use into the future.